National Aeronautics and Space Administration

Aeronautics

Cavity Noise Reduction Technology

Stretchable mesh reduces production and reverberation of high amplitude acoustic waves by preventing coherent airflow

NASA's Langley Research Center researchers have developed a landing gear cavity modification that reduces noise produced during aircraft approach and landing. The modification is an innovative stretchable mesh assembly that deploys and retracts with the landing gear to reduce high intensity low- to mid-frequency airframe noise. The envisioned low profile mesh concept enables mitigation of cavity noise without sealing of the cavity or incurring appreciable penalties of increased weight and conforms easily and smoothly to the interior edges of an aircraft wheel well. The concept is potentially suitable for retrofit of current aircraft and for inclusion into future civil transport fleets, and causes no adverse effects to the aerodynamic characteristics of the aircraft. The technology has been validated in wind tunnel testing. NASA is seeking partners who are interested in co-development or licensure of the technology for a variety of applications.

BENEFITS

- The invention has a simple and low profile design
- The stretchable, compliant nature of the invention enables stowage with un-deployed landing gear
- The concept is effective in reducing low frequency noise by 1-3 dB from 100 Hz to 800 Hz
- Associated lift, drag, and weight penalties are minimal
- Existing aircraft may be retrofitted to incorporate the technology

APPLICATIONS

- Aerospace
  -- Landing gear cavities
  -- Aircraft weapons bays
- Automotive
  -- Automobile sunroofs

technology solution

THE TECHNOLOGY

Attached to the interior edges of the wheel well and covering the entire cavity opening, the stretchable mesh promotes growth of three-dimensional flow structures within the free shear layer. The fine flow structures generated by the mesh effectively reduce shear layer roll-up and eliminate span-wise coherence of the large-scale flow structures immediately downstream of the landing gear cavity leading edge that generate cavity noise. Consequently, the generation of high amplitude acoustic waves and subsequent cavity resonance is significantly diminished. The mesh has been tested in a highfidelity 18% scale model in NASA Langley Research Centers 14- by 22-Foot Subsonic Wind Tunnel. Measurements of acoustic far field noise were collected using a phased microphone array. The stretchable mesh concept is able to reduce the gear cavity noise in excess of one to three decibels from 100-500 Hz, and by about one decibel in the 500-800 Hz range. Sound reduction efficacy of the stretchable mesh construct was compared with rigid mesh and the stretchable mesh has proven more effective in landing gear cavity noise reduction.

Determination of a final embodiment of the stretchable mesh will require design and optimization of the cavity mesh support and attachment fixtures. Further considerations of cost, manufacturability, and maintainability are forthcoming.

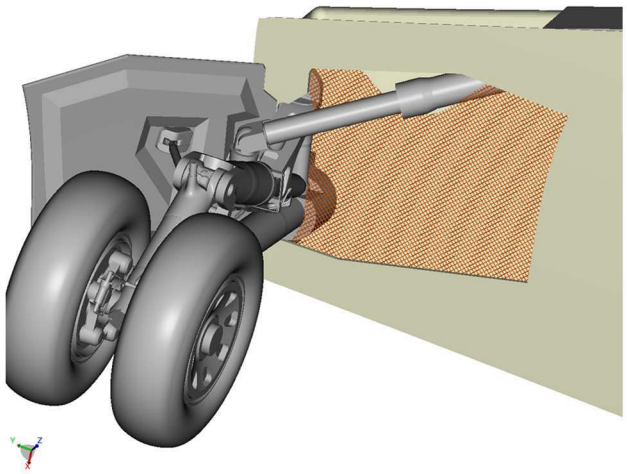

FIGURE 1 - 3D CAD rendering of the stretchable mesh for cavity noise reduction. A prototype has been tested in a wind tunnel environment.

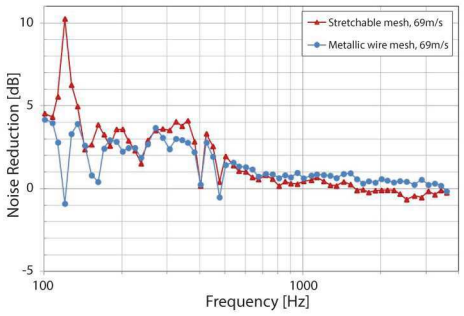

FIGURE 2 - Spectra in flyover direction (from phased array) showing magnitude of reduction in sound pressure levels relative to untreated cavity for stretchable and rigid mesh constructs.

PUBLICATIONS

Patent Pending

More Information

National Aeronautics and Space Administration

The Technology Gateway

Langley Research Center

Mail Stop 151
Hampton, VA 23681
757.864.1178
LARC-DL-technologygateway@mail.nasa.gov

http://technology.nasa.gov/

www.nasa.gov

NP-2014-09-1266-HQ

NASA's Technology Transfer Program pursues the widest possible applications of agency technology to benefit US citizens. Through partnerships and licensing agreements with industry, the program ensures that NASA's investments in pioneering research find secondary uses that benefit the economy, create jobs, and improve quality of life.

LAR-18327-1